Space Weather Technical Forecast

Issued on Monday, 08 August 2022 at 00:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: G1/G2 Minor or moderate geomagnetic storm intervals, Days 1 and 2 (8 and 9 Aug). Chance of Active fluence by Day 3 (10 Aug).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours with mostly minor B-class flares and a couple of common class flare observed at 07/2235UTC and 07/2306UTC. There are currently eight sunspot regions on the visible disc, including three regions very close to the southwest limb, two small unipolar regions in the southeast quadrant, along with a small unipolar spot and two further regions which have recently rotated onto the northeast limb. All of these are small and simple with no significant magnetic complexity. No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, has shown a transition to a high speed stream, likely from CH09. Wind speeds started the day just below 350 km/s, but rose steadily to become elevated later in the day reaching 619 km/s at 07/2210UTC. The density has been average or slightly above average. The total interplanetary magnetic field, Bt, started weak but rose steadily to become moderate, peaking at 15nT at 07/2233 UTC. The north-south component, Bz, was mostly moderately southward directed ranging from +12/-13nT. The Phi angle was mostly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3), becoming active (Kp4) by around 07/1500UTC and a minor geomagnetic storm interval to end the day (Kp5).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16, was at background levels. The high energy electron flux (greater than 2 MeV) was at background levels. Electron fluence was well below the Active (1e8 integrated pfu) threshold on a steady trend. 1.7e6 integrated pfu was observed at 07/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low or very low solar activity is forecast with only a slight chance (5%) of an M-class flare.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Solar winds are forecast to be elevated to fast due to high speed streams related to a couple of coronal holes (CH/09+) and the most notable feature is a large coronal hole (CH/10+) with a likely fast wind arrival on Day 1 (8 Aug), but possibly into Day 2 (9 Aug).
Geomagnetic activity will be Unsettled to Active with an increasing chance of G1/minor geomagnetic storms intervals on Days 1 and 2 (8 and 9 Aug) due to the fast solar wind regime affecting Earth. Geomagnetic activity becoming Quiet to Unsettled from Day 3 (10 Aug).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is

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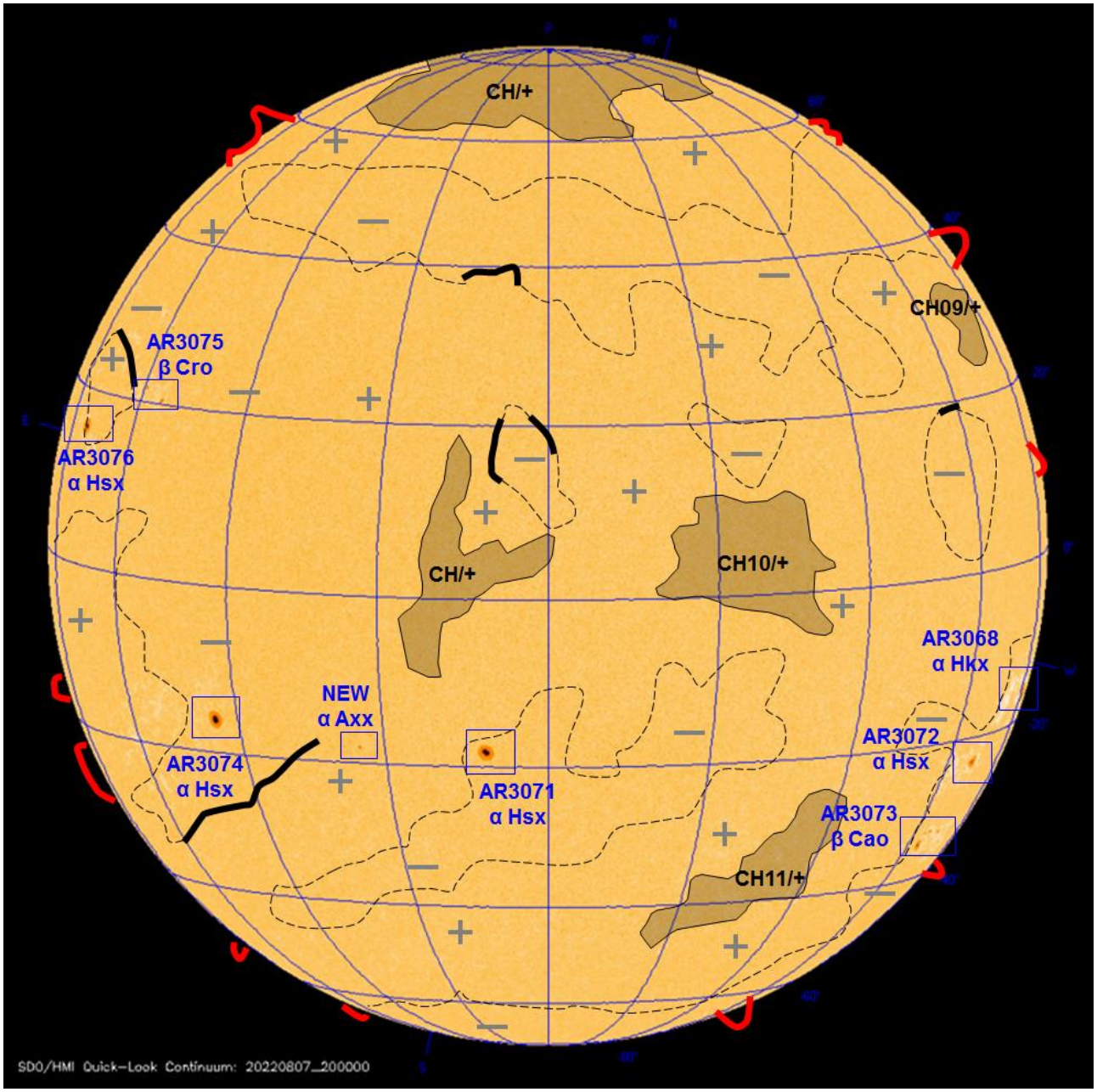
likely to increase through the period, due to high speed stream solar wind charging, perhaps peaking high during periods of diurnal maximum. The associated fluence is expected to remain below the Active threshold (1e8 integrated pfu), but with a rising trend, and a chance of reaching Active by Days 3 and 4 (10 and 11 Aug).

Figure 1. Solar Analysis Valid 2000UTC, 7 August 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

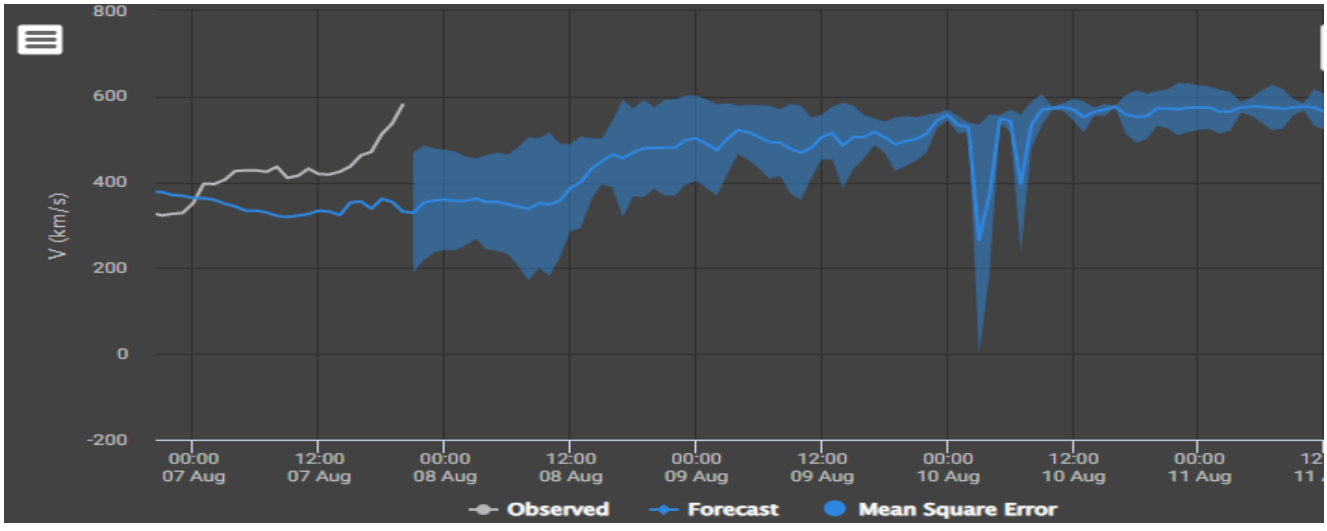
There are no Earth-directed CMEs. Solar winds are currently elevated due to a high speed stream (HSS) from CH09/+, which is a small coronal hole in the northwest of the visible disc. The most notable feature is large coronal hole CH10/+. This is a persistent feature, but larger, darker and more distinct on this rotation. Once the HSS from this feature connects with Earth and the anticipated fast wind arrival, based upon calculation from the leading edge of this feature, would suggest arrival on Day 2 (9 Aug), however 27-day persistence indicates a slight enhancement during Day 1 (8 Aug). Given the more intense appearance of this feature, a faster arrival seems more likely than a slower one, suggesting arrival in the next 12-18 hours is most likely. Enlil also has one broad arrival, providing additional confidence for reduced time between CH09 and CH10 fast winds, with solar winds likely being maintained around 550-600 km/s. Geomagnetic activity will be Unsettled to Active with an increasing chance of G1/G2 minor or moderate geomagnetic storm intervals on Days 1 and 2 (8 and 9 Aug) due to the fast solar wind regime affecting Earth. Geomagnetic activity becoming Quiet to Unsettled from Day 3 (10 Aug).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	80	50	5	1
Strong	G3	No	40	10	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Met Office solar winds prediction model (SWPM), giving good guidance for elevated solar winds.



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Radio Blackouts - X-Ray Flares:

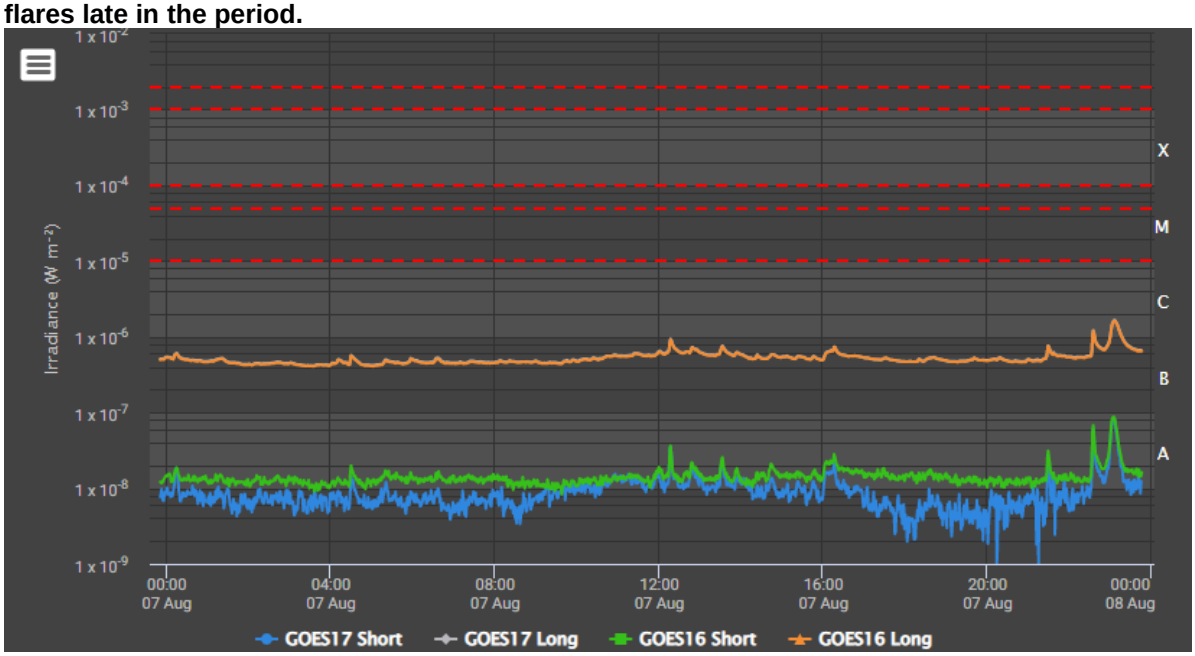
There are currently eight sunspot regions on the Earth-facing side of the solar disc. Despite this, activity has been Low in the last 24 hours, with mostly B-class flares observed and the two C-class flares towards the end of the observing period.

The three active regions in the far southwest, which will rotate across the limb by the start of day 2 (9 Aug) remain small and relatively simple magnetically, with only limited development, however they have been the main source of the recent flares. These are now about to progress westwards beyond 70W, and are becoming more challenging to view and accurately analyse.

There are also two stable unipolar regions in the southeast quadrant along with a new unipolar sunspot located between them. Two further regions have recently rotated onto the northeast limb and these include a small beta region and a larger currently unipolar region. Low to Very Low solar activity is expected to continue over the coming days of this new week, with a chance (40%) of further C-flares occurring each day and a slight chance (5%) of an isolated M-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux plot at GEO showing little activity for much of the past 24 hours with two C-class flares late in the period.



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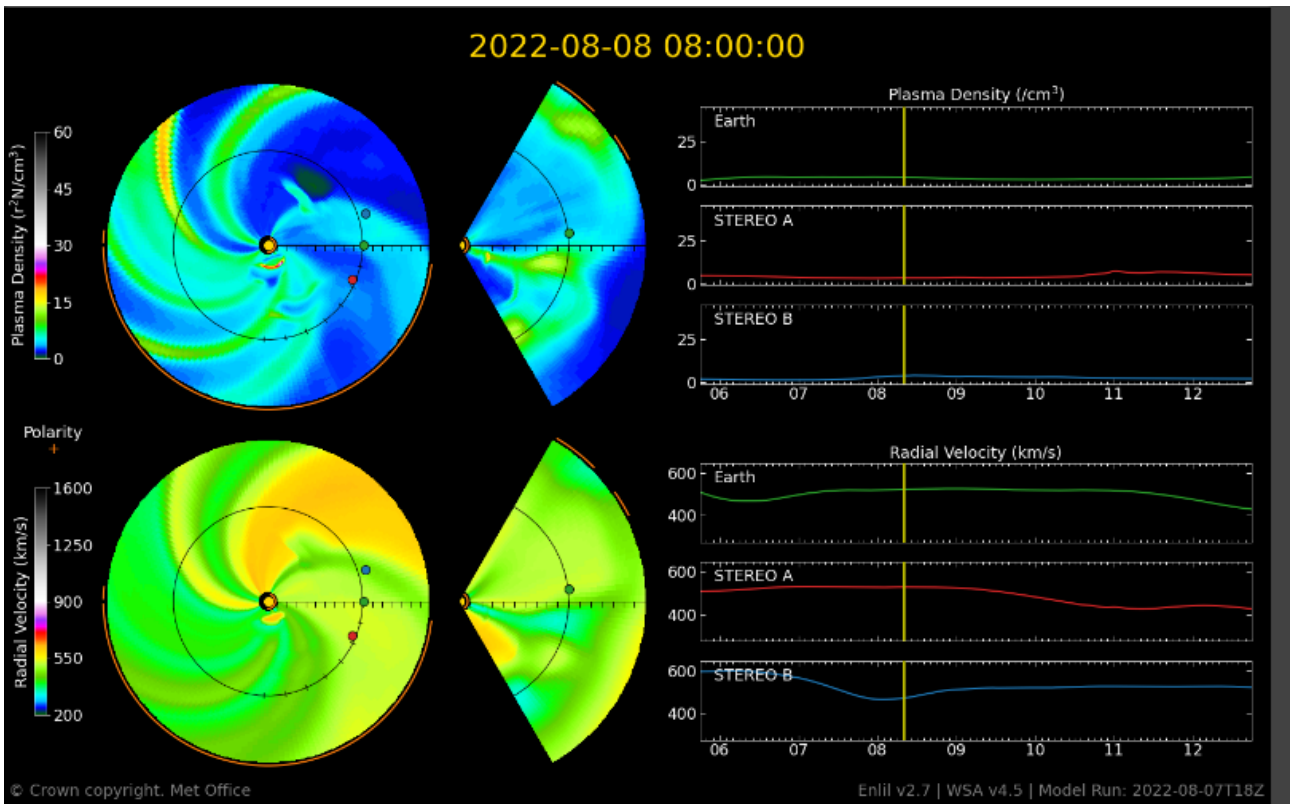
Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is expected remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 4: Met Office ENLIL model output showing high speed streams affecting Earth.



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High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as measured by GOES-16, is currently at background levels. Due to the current enhancement to the solar wind environment from the fast wind of CH09, electron populations amongst the Van Allen Belts are expected to increase as a result. A more notable enhancement is then expected in the next 24 hours as the HSS related to CH10/+ connects. Flux levels are then expected to rise from Day 2 (9 Aug) onward, probably peaking at high during intervals of diurnal maximum. The associated fluence will start below the Active threshold, with a rising trend, and a chance of reaching Active by Days 3 and 4 (10 and 11 Aug). This rising trend, perhaps breaching the Active threshold, is likely to continue beyond the period. This is supported by Met Office REFM output, which maintains levels below Active, but with a steadily rising trend though the forecast period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	20	30	50
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	5

Figure 5: High energy electron flux at GEO and Met Office REFM output.

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